User Manual

Allen-Bradley

Bulletin 1608P HC-DySC Dynamic Voltage Sag Corrector

1608P-200A480V...-HC Models

Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.rockwellautomation.com/literature/) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
	SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

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Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http:/www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

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Introduction

The Allen-Bradley Bulletin 1608P HC-DySC Dynamic Sag Corrector is engineered to provide years of trouble-free voltage sag (dip) protection. The patented DySC technology does not use batteries, requires only routine maintenance, includes three-stage transient voltage surge suppression, and has unparalleled energy efficiency. Most electronic devices found in industry today are susceptible to power disturbances. A momentary sag in line voltage can reset or damage sensitive production equipment. The HC-DySC provides instantaneous dynamic sag correction to help your equipment ride through these common events. The HC-DySC connects normal utility power directly to the load until a voltage sag occurs. During a sag, the HC-DySC inverter is activated-adding missing voltage to keep the load voltage within the normal range. When utility power returns to normal, the inverter is deactivated and the HC-DySC is quickly ready to correct the next sag.

The HC-DySC reports these voltage sag events through its integrated touch screen display and provides system status, voltage sag notification and history, runtime statistics and system history in a simple and intuitive touch-based user interface.

Safety Considerations

The HC-DySC is designed to operate in industrial applications. Follow these guidelines to ensure that the safety and installation of the HC-DySC are handled with appropriate care.

WARNING: HC-DySC products protect diagnostic imaging equipment and facilities support systems against voltage sags and momentary power interruptions. HC-DySC products are not to be used for protection of life-critical patient care equipment.

SHOCK HAZARD: The HC-DySC has high voltage remaining up to 5 minutes after disconnection from the AC line. Touching exposed or disconnected terminals, cables or parts of the HC-DySC can lead to serious injuries or even death. Wait for a minimum of 5 minutes before performing any service or testing on the HC-DySC after power is removed. High voltage remains if red LED indicators above capacitor banks are lighted. Keep the cabinet doors closed and locked to ensure proper cooling airflow and to protect personnel from dangerous voltages inside the HC-DySC.

ATTENTION: - To reduce the risk of fire or electric shock, install this HC-DySC in a temperature and humidity controlled, indoor environment, free of conductive contaminants.

- Avoid installing the HC-DySC directly near heat-emitting equipment such as ovens, heaters, or furnaces.
- Ambient temperature must not exceed 40°C (104°F).
- Do not operate near water or excessive humidity (95% max).
- When punching or drilling holes for conduit fittings, take care to avoid dropping metallic particles inside the enclosure as this can result in electrical damage.
- The system is not intended for outdoor use.
- The operating environment should be maintained within the parameters stated in this manual.
- Only authorized service personnel should perform service on the HC-DySC.
- Ensure all power is disconnected before performing installation or service.

ATTENTION: Internal components can be easily damaged by electrostatic discharge (ESD). Do not touch circuit boards or electronic components with hands or metal objects. The HC-DySC is not rated to directly power life support equipment.

- Ensure the area around the HC-DySC is clean and uncluttered.
- Observe all DANGER, CAUTION, and WARNING notices affixed to the inside and outside of the equipment.

Installation

Installation Check List

Before proceeding, please take a few minutes to review the necessary steps to install your HC-DySC.

- All packing materials and restraints have been removed.
- The HC-DySC is placed in its installed location.
- All conduits and cables are properly routed to the HC-DySC.
- All power cables are properly terminated.
- A ground conductor is properly installed and terminated.
- If neutral connection is required that it is properly terminated on the HC-DySC.
- The area around the installed HC-DySC is clean and dust-free.
- Adequate work space exists around the HC-DySC.
- Adequate lighting is provided around the HC-DySC.
- Operational checks have been reviewed and completed.

Inspecting and Unpacking

- Lift only at the base with a fork truck or pallet jack.
- Carefully inspect the outer packaging for evidence of damage during transit. Do not install a damaged cabinet. Report any damage to the carrier and contact your local sales or service immediately.
- Check the HC-DySC label for correct model number with the packaging list to ensure you have received the correct voltage, current, and wiring configurations.
- After removing the packaging material, inspect the contents for any evidence of physical damage, and compare each item with the Bill of Lading. If damage has occurred or shortages are evident contact your carrier immediately.

Location (Environment)

The HC-DySC must be installed in a protected environment. The location must provide adequate airflow around the HC-DySC in an atmosphere free from excessive dust, corrosive fumes, or conductive contaminants. Do not operate the HC-DySC in an environment where the ambient temperature or humidity is beyond the specified limits given in this manual.

System Components

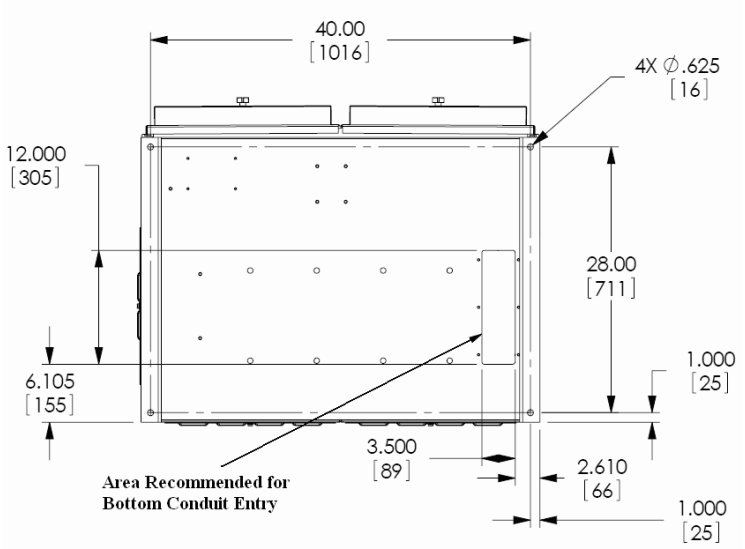
The HC-DySC consists of a single enclosure with an integral mechanical bypass to prevent power disruption during service and maintenance.

Floor Mounting

The HC-DySC is to be secured to the floor using fasteners and fittings appropriate for the type of floor. Holes are provided in the base channels; see Figure 1 for mounting dimensions.

Note: Top or bottom cable entry is allowed. See Figure 1 and Figure 2 on page 9.

Figure 1 - Bottom View Floor Mount Dimensions



Clearance

HC-DySC doors hinge on both right and left. See Figure 30 on page 38 for dimensions including door swing. Leave required clearances:

- Door swing must allow doors to open at least 90 degrees
- 12” [300mm] clearance on left side and rear for cooling airflow
- 4”[100mm] on right side for air filter clearance when right door opens

Circuit Breaker Recommendations

Branch circuit protection upstream of the HC-DySC is required. Recommended circuit breakers and maximum allowed circuit breaker ratings are listed in Table 1. Branch circuit protection rated less than the HC-DySC current rating may result in nuisance tripping.

Table 1 - Recommended Branch Circuit Protection

HC-DySC Rating	Max. MCCB Rating
200 A	250 A

Electrical Terminations

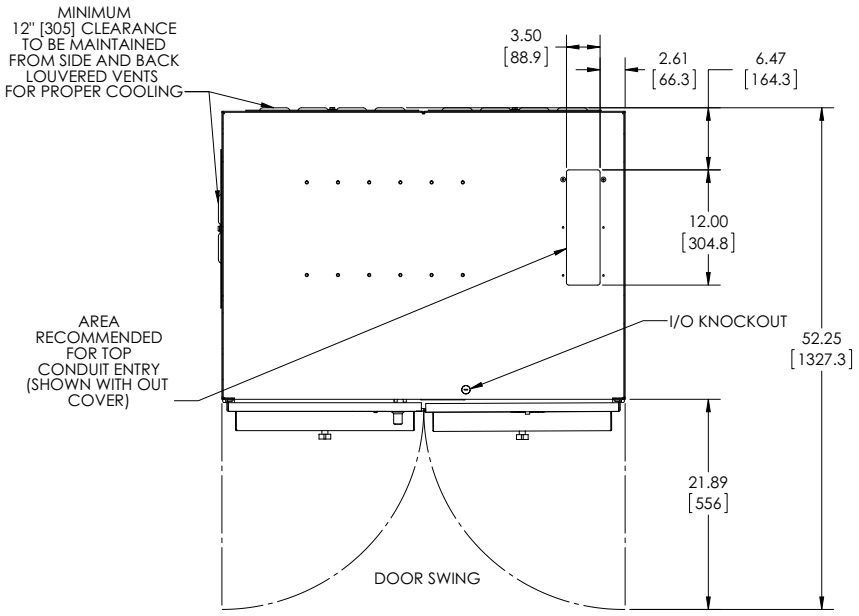
The HC-DySC must be installed by a qualified electrician, in compliance with all local and national electric codes. The HC-DySC input (line) and output (load) terminals are located behind the right door. Terminal details are shown in Figure 5 on page 12.

Accessing Terminations

For top entry remove the top gland plate, shown in Figure 2, to access input and output terminals. This plate may be removed for drilling or punching holes for conduit. Alternate bottom entry should utilize the bottom gland plate shown in Figure 1. Access to the communications port is above the front doors, as shown in Figure 6 on page 13. A separate conduit knock-out is provided for top entry of communications conductors, as shown in Figure 2.

Note: When punching or drilling holes for conduit fittings, take care to avoid dropping metallic particles inside the enclosure. Metallic contamination will void the product warranty.

Figure 2 - Top Conductor Entry



WARNING: Metallic particles inside the enclosure will void the warranty.

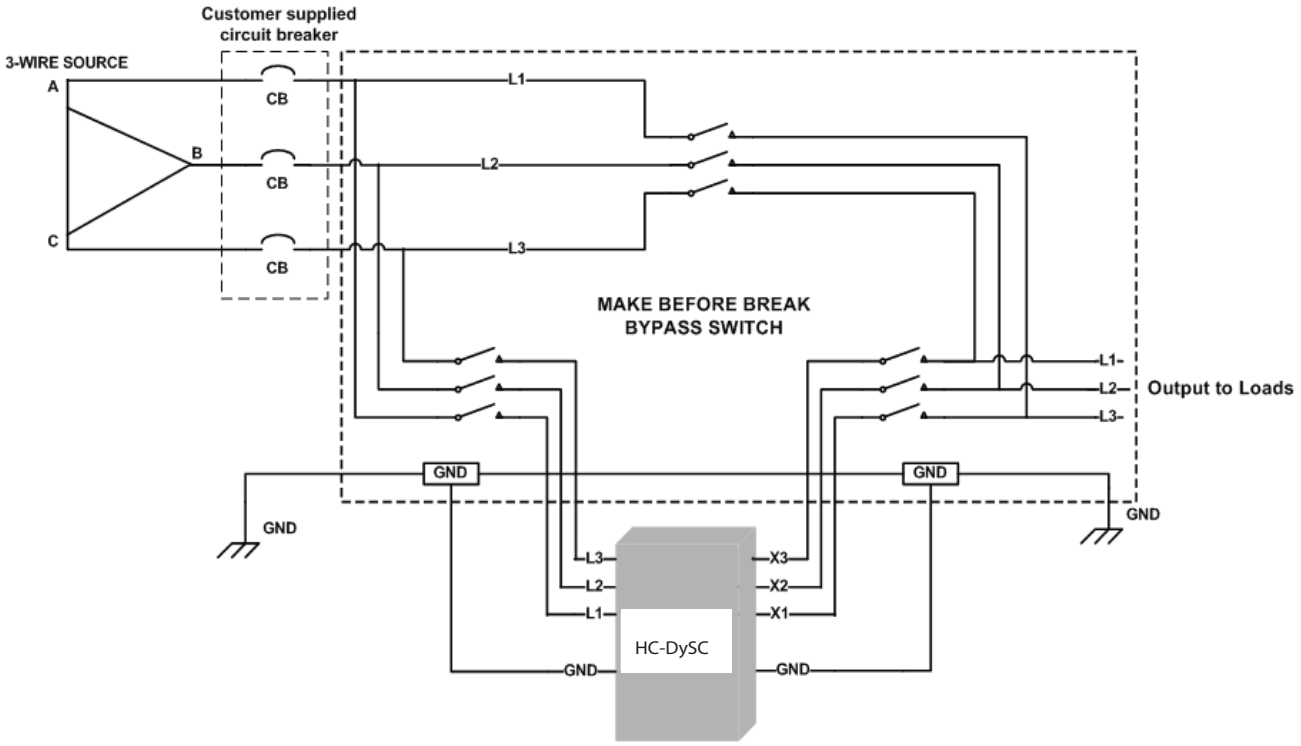
3-Wire vs. 4-Wire Configurations

HC-DySC models are available for use with either 3-wire (L1, L2, L3) or 4-wire (L1, L2, L3, N) sources. The input N conductor must be connected to 4-wire models for proper operation. Do not connect a N conductor to 3-wire models.

3- Wire Models

Bulletin 1608P part numbers containing V3 are configured for 3-wire source (L1, L2, L3) and 3-wire loads (X1, X2, X3). Do not connect a N conductor to 3-wire models. Figure 3 shows the 3-wire HC-DySC system wiring schematically, including the internal Bypass Switch.

Figure 3 - HC-DySC 3-Wire Configuration

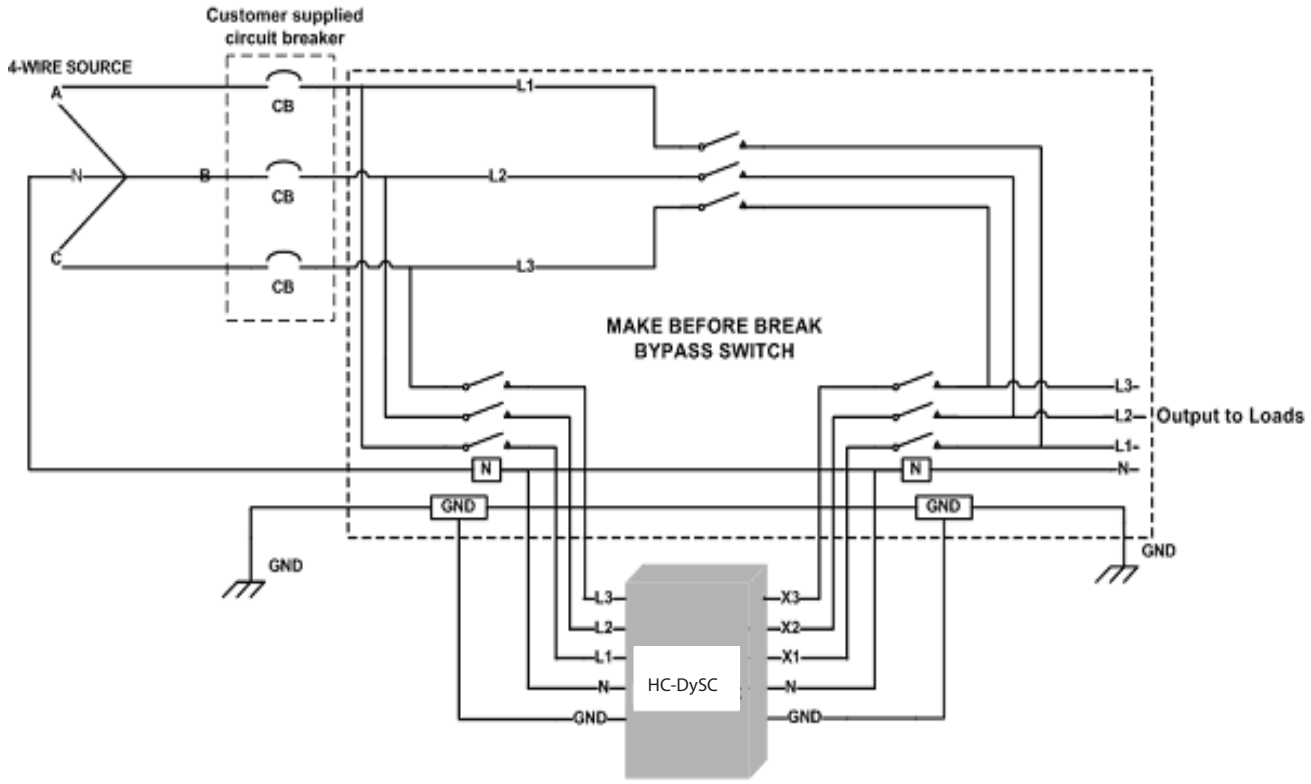


Note: The 3-wire HC-DySC models rated greater than 240V have not been evaluated by Underwriters Laboratories, Inc.® for connection to a corner-grounded or ungrounded delta power source. Contact Rockwell Automation Technical Support for assistance.

4- Wire Models

Bulletin 1608P part numbers containing V4 are configured for 4-wire source (L1, L2, L3, N) and either 3-wire or 4-wire loads. The source N conductor must be connected for proper operation of these models. Connect both input and output N conductors to the bus bar labeled NEUTRAL (See Figure 5). Figure 4 shows the 4-wire HC-DySC system wiring schematically, including the internal Bypass Switch.

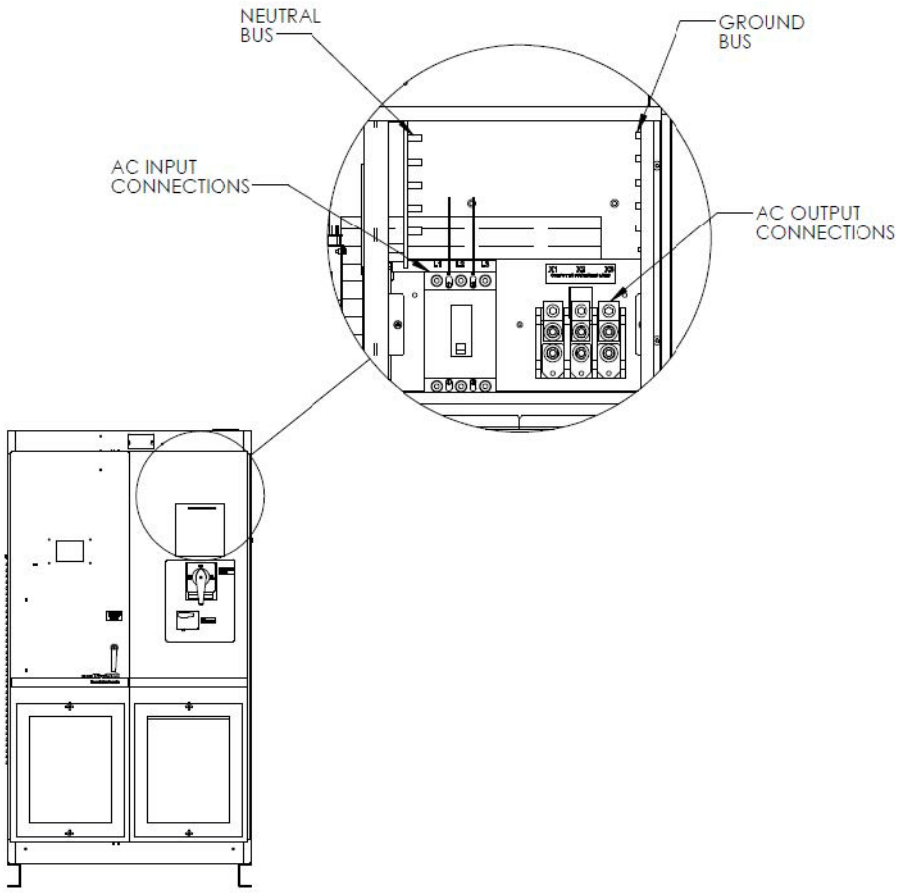
Figure 4 - HC-DySC 4-Wire Configuration.



Electrical Terminations and Ratings

Input terminals (top lugs on CBA) are marked L1, L2, and L3 for the source connections. Output terminal blocks are marked X1, X2, and X3 for the load connections (See Figure 5). In 4-wire models only, connect both input and output N conductors to the NEUTRAL bus bar. Do not connect to the NEUTRAL bus bar in 3-wire models. Replace all shields and covers when wiring is completed. The doors must be closed and latched securely.

Figure 5 - Electrical Terminations



- Input/Output mechanical lugs accept AWG 4 to 350 kcmil [25 to 150 mm^2] conductors. Tighten lugs to 250 lb-in [28.2 N-m]. Lugs require 5/16″ hex key tool for installation.
- Output lugs are mounted on threaded studs and may be removed if desired. Studs are 3/8″ [9.525mm] diameter and nuts should be torqued to 192 lb-in [21.7 N-m].
- NEUTRAL Bus and Ground Bus are provided with 3/8″-16 threaded studs (9.525mm diameter). Tighten nuts to 25 lb-ft (300 lb-in) [33.9 N-m].

WARNING: The HC-DySC must be safety-grounded according to the National Electrical Code. In addition, all local, state, and federal regulations applicable to the installation of electrical systems as well as accident prevention regulations must be strictly observed

Communications

Both dry contacts (relays) that indicate status and a Serial Communications Port (RS-232) are available for monitoring the HC-DySC.

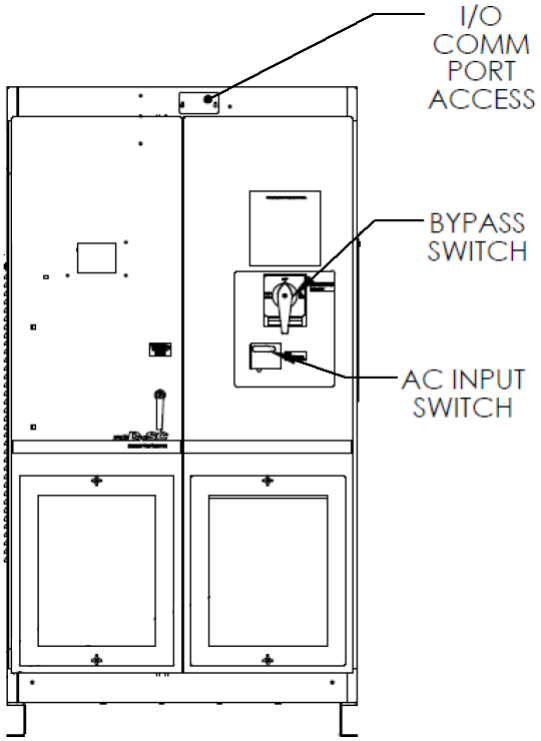
Dry Contacts

Three relay contacts indicate HC-DySC status. The contacts are form A and close upon occurrence of the named event: (a) any SAG EVENT, when rms input voltage drops below 88.5% of rated value; (b) OUTPUT OK, when output voltage remains between 87% and 110%; and (c) a system ALARM event. The relay contact ratings are 24V at 1A.

For access, remove the small metal cover from the top of the HC-DySC (See Figure 6).

- All wiring is to be Class 2, limited to 24 Volts, AC or DC.
- Acceptable wire gauges range from 24AWG to 12AWG (0.205-2.5mm2).
- Torque connections to 5.0 lb-in (0.6 N-m).
- For permanent installation of communications conductors, a standard conduit knockout is located on the cabinet top (See Figure 2).

Figure 6 - Access Cover Location

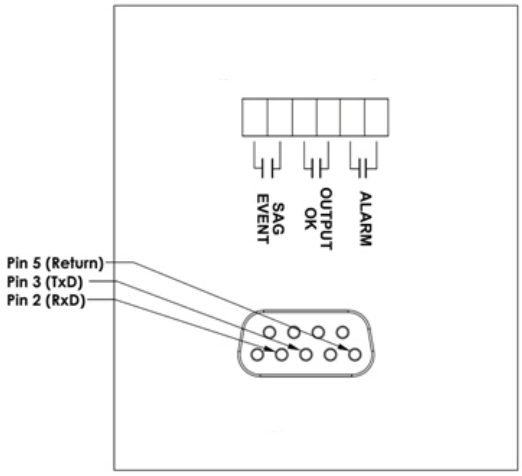


Serial Communications Port

The HC-DySC serial port is a DE-9 female connector. The pin-out follows standard RS-232 protocol: pin 2 is RxD, pin 3 is TxD and pin 5 is common (return). All other pins are unused. Contacts are galvanically isolated from the system power and grounds.

- Protection: The RS-232 port is ESD-protected to 15kV.
- Protocol: 57.6k bps, 8 data bits, one stop bit, no parity, flow control off
- Data packets are SLIP encoded (with 2 byte length field).
- Data accessible through this port includes load voltages, load currents, status, and event and diagnostic logs.
- Consult Rockwell Automation technical support for specifications to the HC-DySC SLIP protocol.

Figure 7 - Serial Communications Port



Applying Power and Operation

Applying Power

- Before applying power to the HC-DySC, make certain there are no metal filings or any conductive debris in or on any components inside the cabinet.
- Verify HC-DySC voltage rating matches ac source voltage.
- Ensure all input/output wiring including grounding has been completed and properly tightened.
- Verify CBA circuit breaker is in the ON position before replacing covers. Replace all covers. Close and lock cabinet doors.
- Put bypass switch in the "BYPASS" position.
- Put CBI circuit breaker in the ON position.
- Apply power from the upstream branch protection device. Power will flow directly to the load through the bypass switch. The HC-DySC touchscreen will become active and display "System Offline" in the upper left corner.
- Verify output (load) voltage is present
- Put bypass switch in the "TEST" position. The HC-DySC system will become energized in this mode but the load will still be powered through the bypass switch.
- Ensure that the touchscreen displays "OK" in the upper left corner, with a bar above that states "Sag Prot. Bypassed." Ensure that the voltage, current, and frequency readings in the status display are correct.
- If a "Critical" or "Fatal" system event appears on the touch screen (1) place the maintenance bypass switch in BYPASS and (2) call for technical support.
- Put the bypass switch in the "NORMAL" position. The load is now being protected by the HC-DySC. The display should show "OK" in the upper left corner.

WARNING: This system is interlocked: Opening HC-DySC doors while the system is in operation will result in loss of power to protected loads, unless the bypass switch is in the Bypass mode (see HC-DySC SYSTEM OPERATION)

NOTICE: Cycling HC-DySC input power in the sequence OFF--ON--OFF--ON within a one minute period will cause a "Limit Cycle Timeout" alarm. In such case sag correction will be inhibited for one minute, after which the alarm will automatically reset.

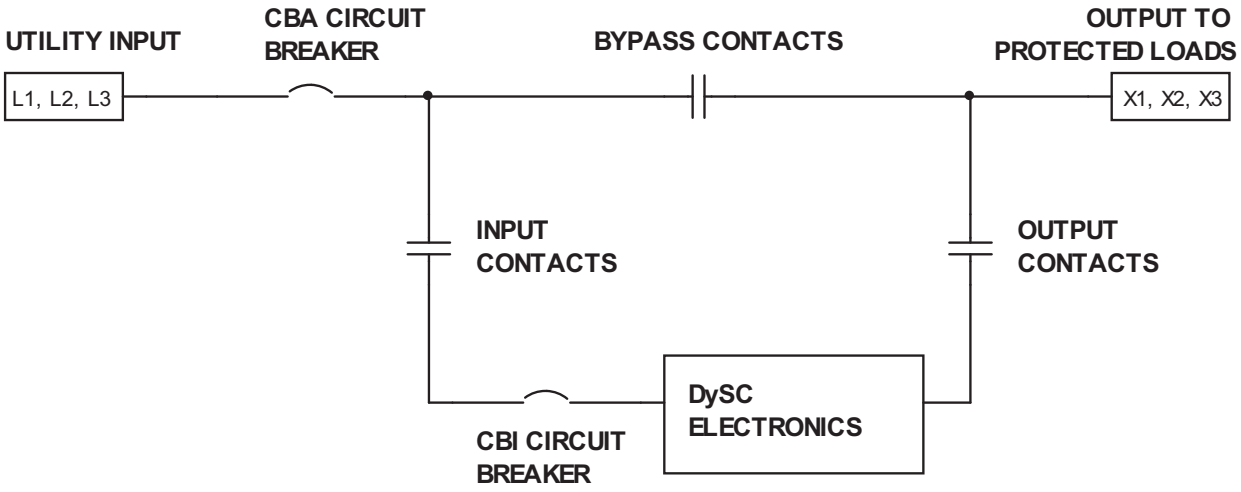
HC-DySC System Operation

SHOCK HAZARD: Dangerous voltages are present within the HC-DySC System. The unit should never be operated with the enclosure door open except by qualified and authorized personnel who are trained and familiar with the operation of the unit and the location of components and voltages. Failure to comply with this warning could result in injury or death.

System Description

The HC-DySC system consists of the DySC dynamic voltage sag correction electronics together with an integral maintenance bypass switch. In the Normal mode of operation the raw utility power is routed through the DySC electronics to protect the loads from voltage sags and momentary interruptions. Figure 8 shows a simplified one-line diagram for the system. Neutral and Ground connections are passed straight through to the loads.

Figure 8 - One Line Diagram of the HC-DySC System



Maintenance Bypass Operation

The HC-DySC has an integral maintenance bypass switch. The maintenance bypass switch is used to avoid power interruptions to the critical loads during maintenance or service. The bypass is a 3 position make-before-break rotary switch.

Bypass Switch Modes

The bypass switch has three modes of operation and is configured as shown in Figure 9.

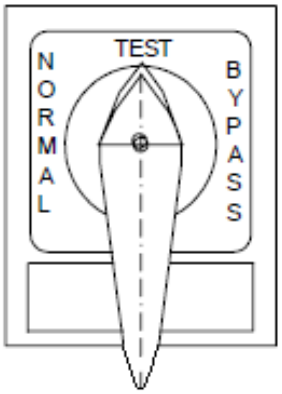


Figure 9 - Bypass Switch and Mode Operations.

• NORMAL Mode – Input and output contacts are closed. Power flows from the utility source through the DYSC electronics to the load.

• TEST Mode – Bypass contacts and input contacts are closed. Power flows directly from the utility to the load through the bypass contacts. DYSC outputs are not connected to the load. DYSC electronics have power provided for testing by a qualified electrician.

• BYPASS Mode – Only bypass contacts are closed. Power flows directly from the utility to the load. No power is present on DYSC inputs or outputs. DySC power electronics are isolated for maintenance or repair.

Maintenance Bypass Transfer Procedure

Manual transfer to Bypass (maintenance) mode:

1. Rotate bypass switch to the Test position, then to the Bypass position.

Note: when the bypass switch is in the Bypass position, CBI circuit breaker will open automatically.

2. Verify the screen on the HC-DySC displays “System Offline” in the upper left-hand corner of the home page.
3. The HC-DySC is now bypassed and isolated for maintenance.

Manual transfer to Normal (sag protection) mode:

1. Rotate CBI handle to the off/reset position then to the on position. Note: HC-DySC prevents re-closure of CBI within 1 minute of opening.
2. Rotate the bypass switch to the Test position. ATTENTION: The bypass contacts are all timed to make-before-break and will not disrupt power to the load during any mode transitions. The switch has lockout/tagout (LOTO) provisions. Delay one second from changing from one position to the next.
3. Verify the screen on the HC-DySC displays “OK” in the upper left-hand corner of the home page.
4. Rotate the bypass switch to the *Normal* position.
5. The HC-DySC system is now providing power to the load.

Operating and Alarm Modes

Under some conditions the HC-DySC will trip the internal circuit breaker CBI to prevent damage to the HC-DySC or to protect loads from severe voltage unbalance. Those conditions are the last four listed in the table below.

ATTENTION: reclosing of CBI will be inhibited for one (1) minute after CBI has opened for any reason. Attempts to close CBI too early will result in immediate re-tripping.

Table 2 - Operational Conditions and Indications

CONDITION	DEFINITION	DISPLAY STATUS*	INVERTER	MODE
Normal:	88.5% < V_{LINE} < 110%	Green "OK"	Standby	Static BP
Sag Event:	V_{LINE} < 88.5% for less than specified runtime	Green "OK"	Running	Inverter
Runtime Exceeded:	Cumulative runtime exceeded	Blinks Red, then Orange for 1 min. Repeats if condition persists	Inhibited	Static BP
Normal Mode, Overload:	Load current > 110%	Red during OL condition, Orange for 1 min. after OL ends	Inhibited	Static BP
Output Over-Current while inverter running (I2t)	Load current > 150% for 3 cycles	Blinks Red, then Orange for 1 min. Repeats if condition persists	Inhibited	Static BP
Inverter Module Over-temperature:	Module temperature limit exceeded	Blue, HC-DySC offline	Disconnected	CBI open
HC-DySC cabinet Over-temperature:	Internal temperature limit exceeded	Blue, HC-DySC offline	Disconnected	CBI open
Static Switch Failure:	Open SCR(s)	Blue, HC-DySC offline	Disconnected	CBI open
Main Fuse Open	Open Fuse(s)	Blue, HC-DySC offline	Disconnected	CBI open
Enclosure Door Open:	Door Open	Blue, HC-DySC offline	Disconnected	CBI open

* The touchscreen will power down if both input and output voltages fall below 75% of nominal. An error message will be displayed while the red or orange text box is displayed. Refer to Chapter 5 for further information on accessing fault codes and status history.

Display Screen

Overview

The HC-DySC® touch screen display is a window to voltage sags and HC-DySC protection. The display provides system status, voltage sag notification and history, runtime statistics and system history in a simple and intuitive touch-based user interface.

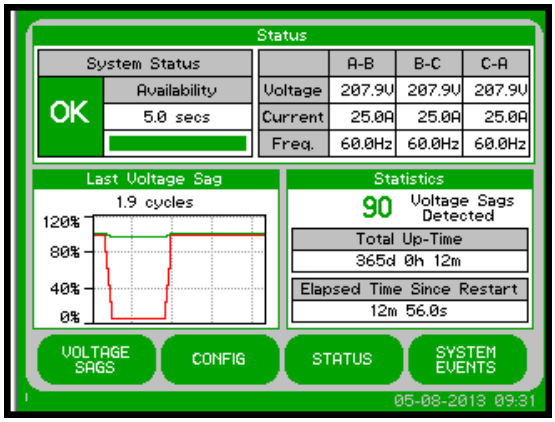
When the system first starts, a welcome screen displaying the HC-DySC product logo appears. This screen disappears after 5 seconds, when the "Home" screen appears.

Note: The touch screen is optimized for use with a plastic stylus or bare finger.

At installation time perform the following steps to configure your system:

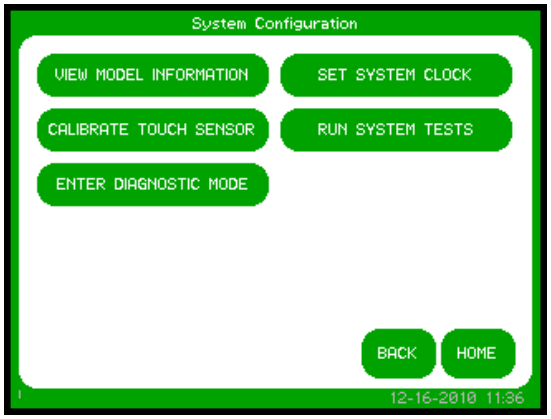
Step 1: Press the "CONFIG" button at the bottom of the "HOME" screen (See Figure 10).

Figure 10 - Home Screen



Step 2: Begin calibration by pressing "CALIBRATE TOUCH SENSOR" (See Figure 11).

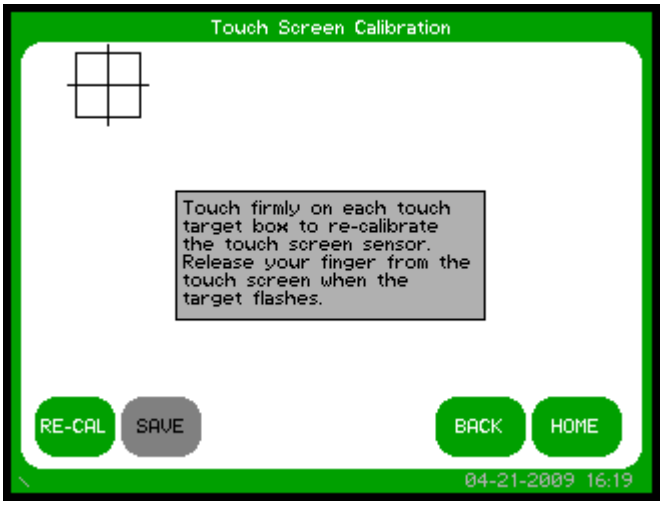
Figure 11 - System Configuration



Note: To recalibrate from any screen, hold anywhere on the screen for 10 seconds. You will see a small progress bar at the bottom of the screen. When the progress bar reaches 100 percent, the calibration screen will open.

Step 3: The "Touch Screen Calibration" screen will then appear (See Figure 12). Press and hold on the center of the touch target, release when the touch target begins to flash. Repeat with the next two touch targets.

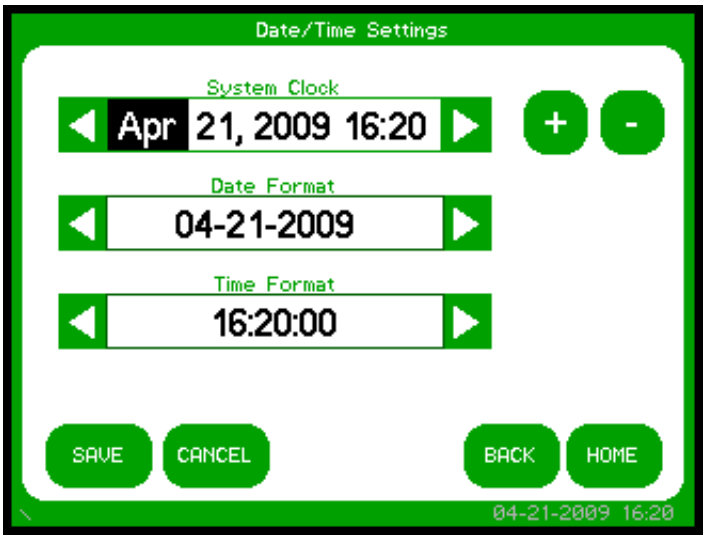
Figure 12 - Touch Screen Calibration



Step 4: The screen uses the new calibration configuration. You can test the calibration before saving by pressing anywhere on the screen to ensure the touch target appears where you press. After testing, press the "SAVE" button. Press the "BACK" button to return to the "System Configuration" screen.

Figure 13 - Set System Date and Time

Step 5: Set date and time by pressing "SET SYSTEM CLOCK" in "System Configuration." Press "SAVE" when completed.



Home Screen

The “HOME” screen of the display provides a snapshot view of the status of the entire system (See Figure 14). You can return to this screen from any other screen by pressing the “HOME” button. After 5 minutes of inactivity (i.e. not pressing the screen), the touch screen will automatically return to the “HOME” screen. The “HOME” screen is divided into four main areas described inTable 3.

Figure 14 - Home Screen

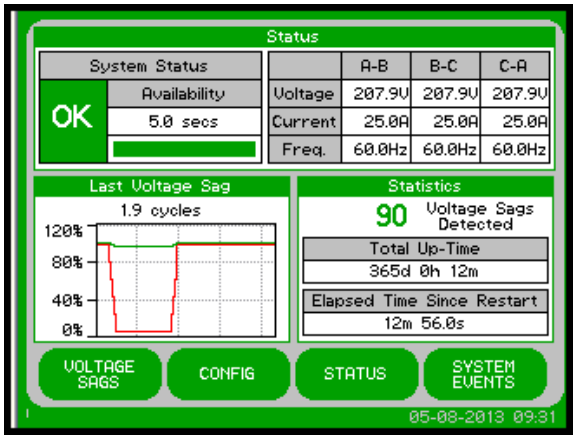


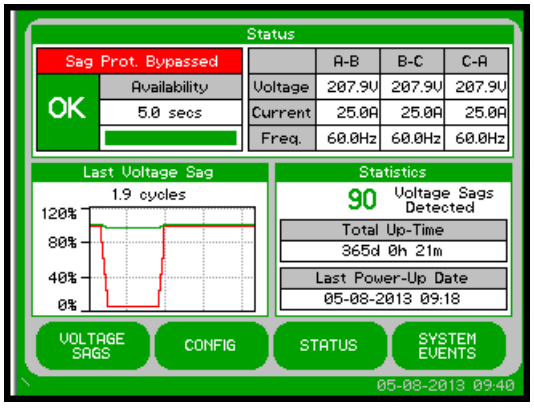
Table 3 - Home Screen Description

Description	Function	
Status	Real-time system operation: available runtime, output line-to-neutral (L-N) or line-to-line (L-L) voltage (model dependent), load current, and frequency	
Last Voltage Sag	Rotating information about the last voltage sag: event start time, event duration, and sag depth	
Statistics	Summary view of HC-DySC performance based on sags detected, plus a rotating display of last power-up date, elapsed time (since power up), and total up-time	
Main Menu	The menu buttons at the bottom of the screen navigate through: **VOLTAGE SAGS:** Displays the “Voltage Sag Log” screen **CONFIG:** Displays the “System Configuration” screen	**STATUS:** Displays the “System Status” screen **SYSTEM EVENTS:** Displays the “System Event Log” screen

Mechanical Bypass

Some systems equipped with a mechanical bypass display the bypass status in the System Status panel on the Home Screen. When the mechanical bypass is closed, the DySC unit is bypassed and voltage sags on the line will NOT be corrected.

Figure 15 - Home Screen Mechanical Bypass



System Status

The “System Status” screen displays the real-time overall system status. Reach this screen by pressing “STATUS” on the “HOME” screen or the “Status” area at the top of the “HOME” screen

Figure 16 - System Status Summary

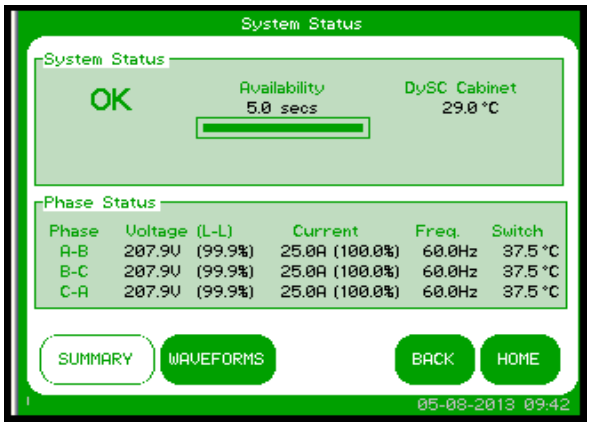


Figure 17 - - System Status Waveforms

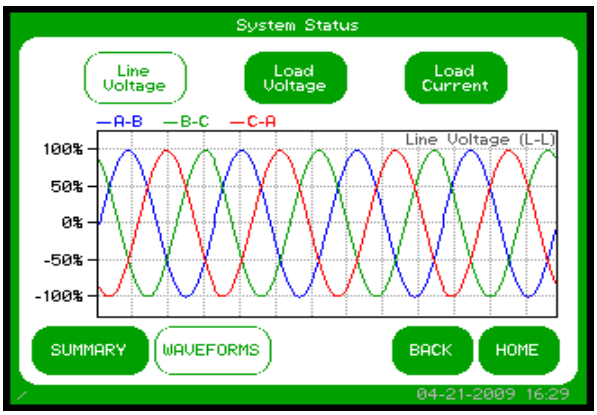


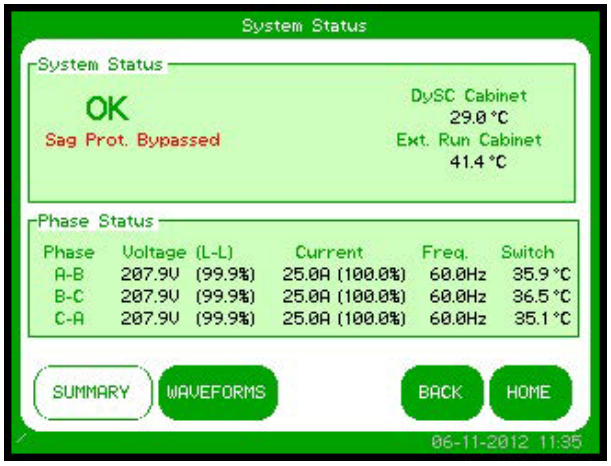
Table 4 - System Status Description

Description	Function
System Status	Overall system status including current operational status, availability to correct sags, and internal cabinet temperature
Phase Status	Voltage, current, frequency, and static switch temperature are displayed for all phases. The percentage displayed following the voltage and current is the percent of nominal value for the HC-DySC. Nominal values are listed on the “View Model Information” screen.
Waveforms	A sample of a 4 cycle waveform that includes real-time line voltage, load voltage, or load current can be selected for display

Mechanical Bypass

Some systems equipped with a mechanical bypass will display the bypass status in the System Status panel on the Status Screen. When the mechanical bypass is closed, the DySC unit is bypassed and voltage sags on the line will NOT be corrected.

Figure 18 - Status Screen Bypass Status



Voltage Sag Events

A voltage sag is defined as the period when input RMS voltage drops to less than 88.5% of the rated DySC voltage. Details of each voltage sag and corresponding HC-DySC protection are captured and saved to the voltage sag log.

Voltage Sag Log

The "Voltage Sag Log" screen (See Figure 19) displays a list of the last 61 voltage sags. Reach this screen by pressing "VOLTAGE SAGS" button on the "HOME" screen.

Figure 19 - Voltage Sag Log

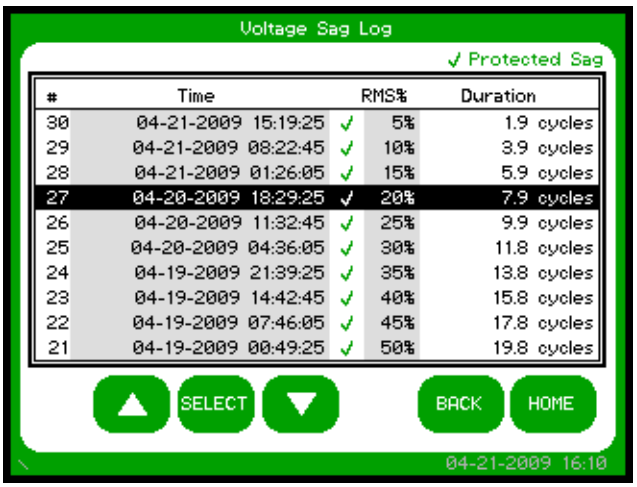


Table 5 - Voltage Sag Log Description

Description	Function
#	Unique ID within the list (0-60) to identify the voltage sag
Time	Start time and date of the voltage sag
Check Mark	Denotes the HC-DySC protected the voltage sag
RMS%	Worst-case RMS voltage (percent of nominal) across all phases
Duration	Duration of the voltage sag

Note: Use the up/down arrows to navigate through the list. Press the "SELECT" button to view additional details about the voltage sag

Voltage Sag Detail

Voltage Sag Detail" screen (See Figure 20) displays all information related to the selected event. Details for the most recent sag event can also be accessed by pressing anywhere in the Last Voltage Sag area of the HOME screen.

The worst-case RMS voltage recorded during the event is displayed in the upper window along with the corresponding voltage percentage and the event duration. Table 6 describes the remaining screen content.

Figure 20 - Voltage Sag Detail

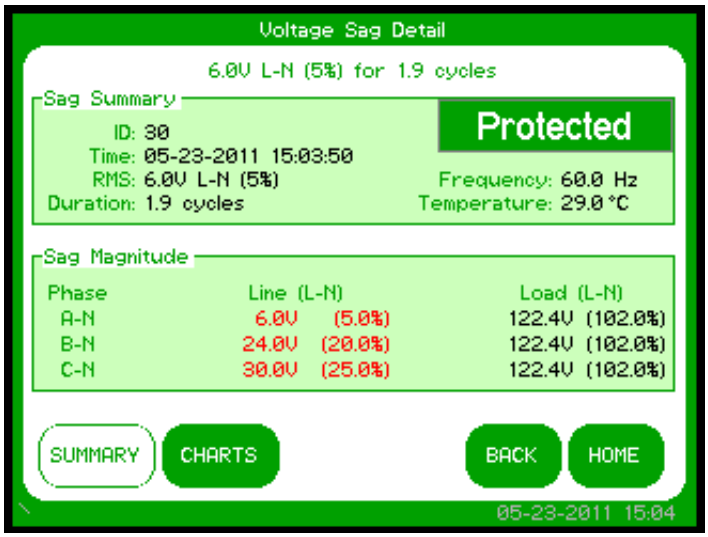


Table 6 - Voltage Sag Detail Description

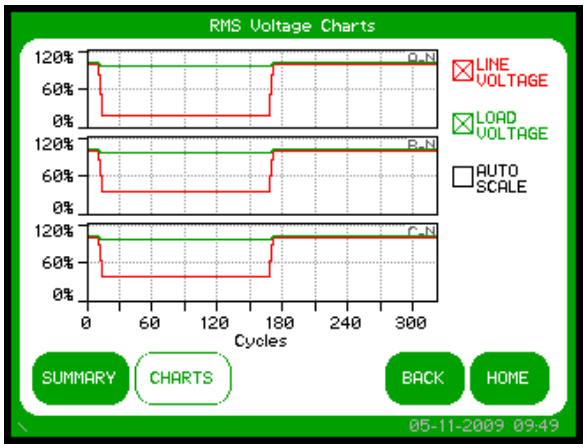
Description	Function
Sag Summary	**ID**: Unique ID within the list (0-60) to identify the voltage sag **Time:** Start time of the voltage sag **RMS:** Worst-case RMS voltage (L-N) and percent of rated voltage across all phases **Duration:** Duration of the voltage sag **Frequency:** Frequency of the line prior to the start of the voltage sag **Temperature:** Internal temperature of the HC-DySC prior to the start of the voltage sag
Sag Magnitude	**Line Voltage:** Line RMS voltage and percent of rated (L-N). Voltages ≤ 80% of nominal are displayed in red. **Load Voltage**: Load RMS voltage and percent of nominal (L-N).
Correction Result	The "Correction Result" is displayed in a box in the upper-right-hand corner of the "Event Summary" section. The "Correction Result" conveys how the HC-DySC performed correcting the voltage sag. The possible values are: **Protected**: The output RMS voltage on all phases is ≥ 85 percent of nominal and the HC-DySC correction was active for the duration of the voltage sag (will be displayed in green). **Run Error**: An unexpected system event occurred during the sag (will be displayed in orange) **Run Inhibited**: The HC-DySC system was inhibited when the sag occurred (will be displayed in orange).

Note: The "Voltage Sag Detail" for the most recent event can also be accessed by pressing the "Last Voltage Sag" area of the "HOME" screen.

Voltage Sag RMS Voltage Charts

The line and load RMS voltage (L-N) of each phase is recorded for 8 cycles prior to the start of the voltage sag followed by the first 300 cycles of the voltage sag (See Figure 21). Reach this screen by pressing "CHARTS" on the "Voltage Sag Detail" screen as shown in Figure 20 on page 24.

Figure 21 - RMS Voltage Charts



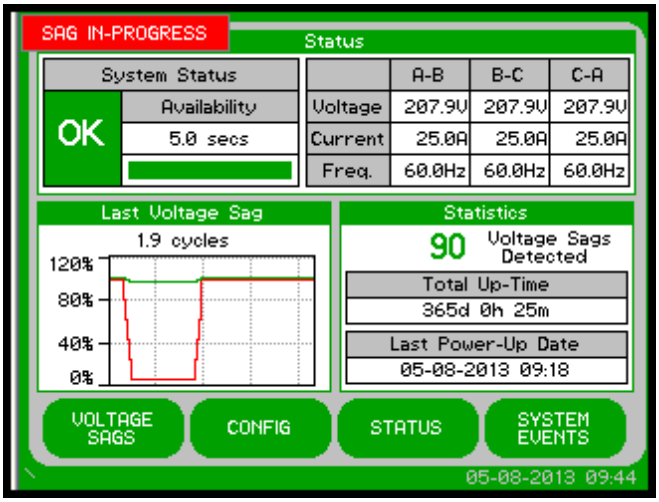
Line voltage is shown in red and load voltage is shown in green. By pressing the check boxes in the right column, you can toggle each data series Off and On as well as enable y-axis auto-scaling.

Note: 300 cycles = 5.0 seconds at 60 Hz or 6 seconds at 50 Hz.

Voltage Sag Notification

While the voltage sag is in-progress, a flashing red box in the upper left-hand corner will display "SAG-IN-PROGRESS." This box will appear on every screen until the voltage sag ends. See Figure 22.

Figure 22 - Voltage Sag Detected



System Events

The HC-DySC tracks all operational events which are classified into five groups based on severity.

Table 7 - System Event Description

Description	Function
Informational	Purely informational. No action is required.
Auto-Resetting	The HC-DySC will reset within 60 seconds. No user action is required.
User Attention	User action may be required to correct a problem. The HC-DySC will reset 60 seconds after the error condition is corrected.
Manual-Reset	For system events that cause circuit breaker CBI to open a manual reset of the DySC system will be required.
Call Service	For events classified as Call Service, factory trained service support will be required. Contact Rockwell Automation technical support.

System Event Log

The "System Event Log" screen displays a list of the last 40 system events in chronological order (See Figure 23). Reach this screen by pressing "SYSTEM EVENTS" on the "HOME" screen.

Figure 23 - System Event Log

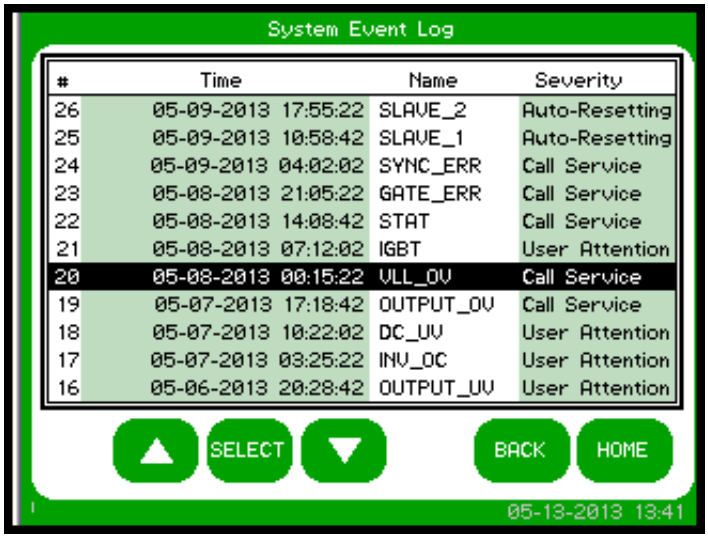


Table 8 - System Event Log Description

Description	Function
#	Unique ID (0-39) to identify the system event (unique within the list)
Time	Start time of the system event
Name	Short name of the system event.
Severity	Severity of the system event

Note: Use the up/down arrows to navigate through the list. Press the "SELECT" button to view additional detail about the system event.

System Event Detail

The "System Event Detail" screen is displayed when a specific system event is selected by pressing on the "SELECT" button on the "SYSTEM EVENT LOG" screen (See Figure 23 on page 26). It provides detailed information that was recorded during the event (See Figure 24).

Figure 24 - System Event Detail

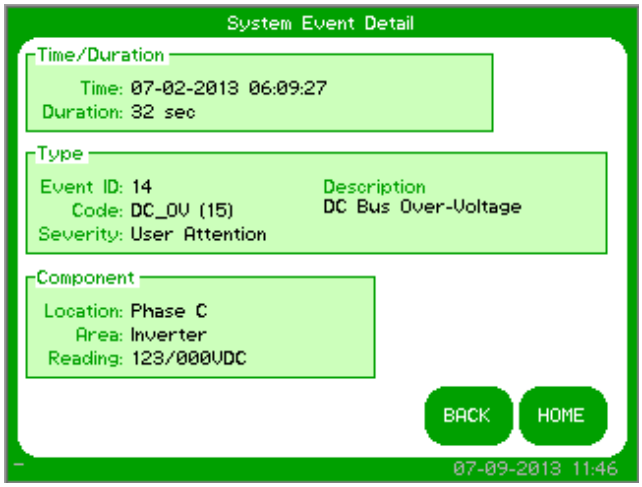


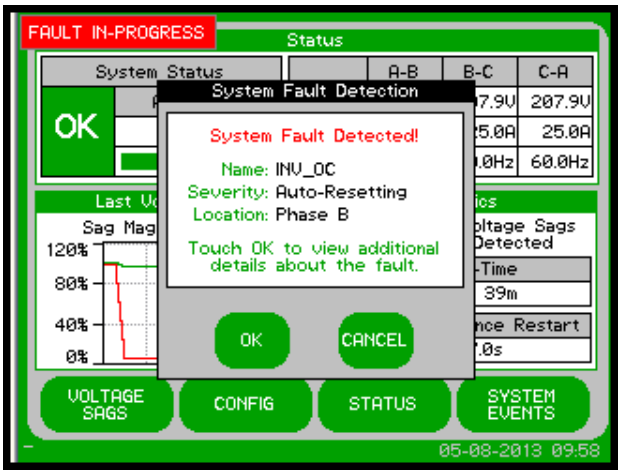
Table 9 - System Event Detail

Description	Function
Time/Duration	**Time:** Date and start time of the system event **Duration:** The amount of time the event lasted.
Type	**Event ID:** Unique ID within the list (0-39) to identify the event. **Code:** Abbreviation of the event followed by a numeric event code in parentheses. (For a list of codes and abbreviations see Table 11 on page 32 **Severity:** Severity of the event **Description:** Name of the event see Table 11 on page 32
Component	**Location:** The location in the system where the event originated (i.e. Phase A, Phase B, Phase C, etc.). **Area:** The specific area within the location where the event originated (i.e. Inverter, etc.). **Reading:** a data value relevant to the System Event may be recorded in some cases, e.g., detail for an "Inverter Over-Current" alarm would include a reading of the causal high current value. The reading "N.A." is displayed if no appropriate data value exists.

System Event Notification

When the HC-DySC system first detects an event condition, the "System Fault Detection" dialog box will be displayed (See Figure 25). Within the "System Fault Detection" box, the name, severity, and location of the event will be displayed.

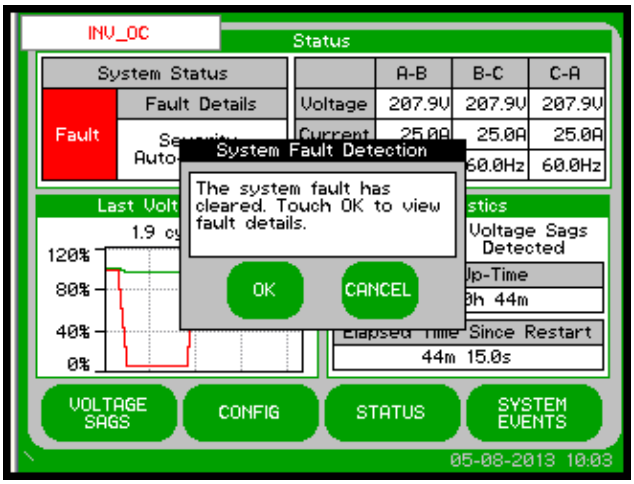
Figure 25 - System Fault Detection



Pressing the "OK" button will open the "System Event Detail" screen. The event will appear in the event list after the event is over. The window can be closed by pressing the "CANCEL" button or waiting 15 seconds.

When the event condition clears, a new dialog box will be displayed. Press "OK" to view the complete event detail, or "CANCEL" to close the dialog box (See Figure 26).

Figure 26 - System Fault Detection - Cleared

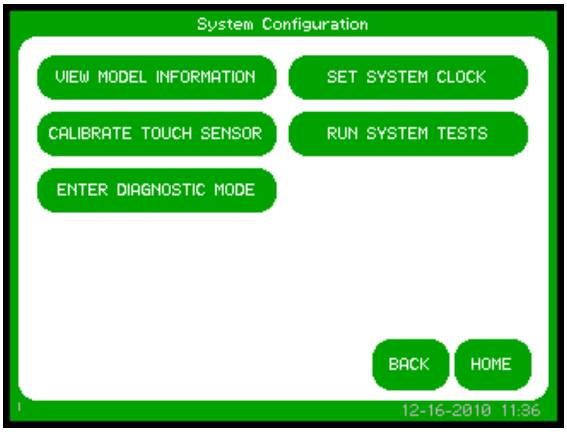


If a "Call Service" severity event is detected, record the event details including: name, description, location, and reading. Contact product support immediately. If the event clears, the touch screen will automatically go back to normal operation.

System Configuration

Press the “CONFIG” button at the bottom of the “HOME” screen to enter the “System Configuration” screen (See Figure 27). The “SET SYSTEM CLOCK” and “CALIBRATE TOUCH SENSOR” functions are described at the start of this chapter.

Figure 27 - System Configuration



Model Information

Touch “VIEW MODEL INFORMATION” to go to the “Model Information” screen. (See Figure 28).

Figure 28 - Model Information

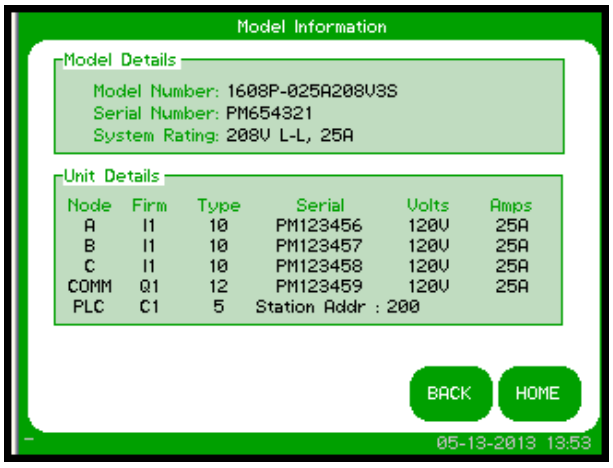


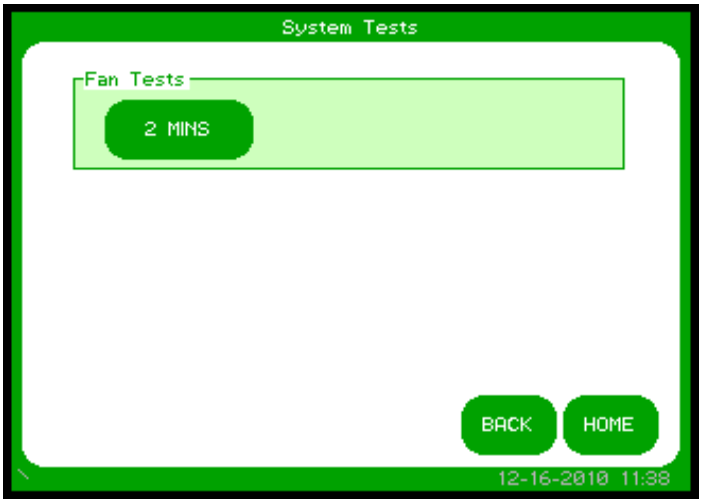
Table 10 - Model Information

Description	Function
Model Details	**Model Number:** System Model number **Serial Number:** System serial number **System Rating:** System voltage and current ratings
Unit Details	**Node:** The location index for the details listed to the right **Firm:** The firmware version for the location indexed. **Type:** Unique code specifying firmware part number for the location indexed. **Serial:** The serial number for the location indexed **Volts:** The rated voltage for the locations **Amps:** The rated current for the location indexed

Run System Tests

Press the “RUN SYSTEM TESTS” to enter the “System Tests” screen. Press “2 MINS” to run the system fans for 2 minutes (See Figure 29).

Figure 29 - System Tests



Diagnostics Mode

This is not a user function. It is numerical code protected for authorized service personnel.

Maintenance

Preventative Maintenance

The HC-DySC requires very little preventative maintenance. The HC-DySC should be checked periodically for proper air flow and status indicator operation.

Monthly Checks

- Ensure the touch screen display is working and no active events are displayed.
- Verify that the bypass switch is in the NORMAL mode.
- Update system time, if needed, Figure 13 on page 20.
- Use a soft cloth to clean the touch display. DO NOT USE harsh detergent, abrasive sponges, alcohol, ammonia, toluene, or acetone on the touch display.
- Ensure air intake and exhaust filters are not covered or obstructed.

3-6 Month Checks

- Check air filters and clean when necessary.
  - Air filters for the HC-DySC will require periodic cleaning, with the frequency depending on the environment. Filters are located on the front side of the HC-DySC, and can be accessed with the door closed. The HC-DySC need not have power removed for this operation. Remove the grill covers by unscrewing the knurled nuts; the washable foam filter pads are behind the grill cover. Gently wash the foam filter pads as needed with a light non-abrasive soap and water mixture. Towel-dry; do not wring-out. Place the filter and grill cover back into their location and replace the screw caps by rotating clockwise until finger tight. Replace filter if damaged. Consult Rockwell Automation technical support for replacement filters. Replacement filters must be no more restrictive to air flow than the original equipment filters.
- Check fan for proper operation.
  - Tap on “CONFIG” on the touch screen display. Tap on “Run System Test”. This will bring up a “System Test” screen to test the fans. After tapping the “Fan Test” button, you should hear the fans run for two minutes.

Table 11 - System Event Table

Event Code	Code Name	Full Name	Severity	Area	Event Description	Event Resolution
1	POWER_ON	DySC Power On	Informational	Unit	Power re-applied to the DySC.	No action needed.
4	T_FAN_ST	Fan Test Start	Informational	Unit	Start acknowledgment of DySC fan test.	No action needed.
5	T_IN_ST_1	Inverter Test (.5 cycles) Start	Informational	Unit	Start acknowledgment of DySC 0.5 cycle inverter test.	No action needed.
6	T_IN_ST_2	Inverter Test (3 cycles) Start	Informational	Unit	Start acknowledgment of DySC 3 cycle inverter test.	No action needed.
7	T_IN_ST_3	Inverter Test (5.5 seconds) Start	Informational	Unit	Start acknowledgment of DySC 5.5 second inverter test.	No action needed.
9	EXTERNAL	External Inhibit	Auto-Resetting	Inverter	Controller is inhibited by another phase controller.	Review event details from other phase controllers.
11	RUN_TO	Inverter Run Time out	Auto-Resetting	Inverter	DySC inverter had a total cumulative runtime of more than rated.	No action needed.
12	LIM_CYCLE	Inverter Limit Cycle Timeout	Auto-Resetting	Inverter	Power was re-applied more than once within a 58 second period.	No action needed.
13	STAT_OT	Static Switch Over-Temperature	User Attention	Static Switch	Static switch heatsink temperature was greater than maximum rating.	Verify ambient temperature is within DySC specification. Check for damaged fans. Check for dirty or obstructed air filters.
14	OVERLOAD	Overload	User Attention	Unit	Inverter inhibited because load current exceeded maximum rating.	Reduce load. In parallel DySC systems, verify proper current sharing among slave cabinets.
15	DC_OV	DC Bus Over-Voltage	User Attention	Inverter	Positive or negative half of DC bus voltage exceeded maximum rating.	Verify line voltage is within ratings. Verify proper DySC application. Call service.
16	CNTRL_UV	Controller Power Under-Voltage	User Attention	Inverter	DySC control power supply is out of tolerance.	Verify DySC is online and line voltage is within ratings. Call service.
17	OUTPUT_UV	Output Under-Voltage	User Attention	Inverter	DySC output voltage was less than 80% of nominal during sag correction. Sag condition likely outside of DySC specification.	Verify line voltage is within ratings. Verify proper DySC application.
18	INV_OC	Inverter Over-Current	User Attention	Inverter	Inverter current exceeded maximum rating during sag correction.	Verify load current is within ratings. Verify mechanical bypass switch is open. Verify proper DySC application.
19	DC_UV	DC Bus Under-Voltage	User Attention	Inverter	DC bus voltage below operational range.	Verify line voltage is within ratings. Call service.
20	OUTPUT_OV	Output Over-Voltage	Call Service	Inverter	DySC output voltage was greater than 115% of nominal during sag correction.	Call service.
25	SYNC_ERR	Line Synchronization Error	Call Service	Inverter	Inverter not synchronized to line when sag detected.	Call service.
31	CONFIG	Configuration Alert	Call Service	Inverter	Controller configuration has changed.	Call service.
32	CNTRL_MEM	Controller Memory Busy	Auto-Resetting	Inverter	Controller is loading new data into Flash memory.	No action needed.
33	UNBALANCE	Start-Up Test: DC Bus Unbalance	Call Service	Inverter	Positive and negative halves of the DC bus did not charge equally during power up.	Call service.
34	AC_V_CHK	Start-Up Test: AC Voltage Check	Call Service	Inverter	Output voltage was detected out of tolerance during the start-up test.	Call service.
35	ROLL_CALL	Start-Up Test: Controller Roll Call Timeout	Call Service	Unit	Controller communication problem detected during start-up test.	Call service.

Event Code	Code Name	Full Name	Severity	Area	Event Description	Event Resolution
36	COM_VER	Start-Up Test: Communication Compatibility Mismatch	Call Service	Unit	Firmware communication compatibility problem detected during start-up test.	Call service.
37	CNFG_TO	Start-Up Test: Controller Configuration Timeout	Call Service	Unit	Controller communication problem detected during start-up test.	Call service.
38	CNFG_ERR	Start-Up Test: Controller Configuration Mismatch	Call Service	Unit	Controller firmware configuration problem detected during start-up test.	Call service.
39	FIRM_TO	Start-Up Test: Controller Firmware Check Timeout	Call Service	Unit	Controller communication problem detected during start-up test.	Call service.
40	FIRM_DIFF	Start-Up Test: Controller Firmware Revision Mismatch	Call Service	Unit	Controller firmware revision mismatch detected during start-up test.	Call service.
41	SRL_TO	Start-Up Test: Controller Serial Number Check Timeout	Call Service	Unit	Controller communication problem detected during start-up test.	Call service.
42	SRL_DIFF	Start-Up Test: Serial Number Mismatch	Informational	Unit	Controller serial number mismatch detected during start-up test.	No action needed.
44	T_INV_TO	Inverter Test Timeout	Call Service	Unit	Phase control board failed to respond to Comm board's Inverter test.	Call service.
46	DOOR_OPEN	DySC Cabinet Door Open	Manual Reset	Unit	DySC door was opened. Mechanical bypass commanded.	Close door. Manually reset DySC.
47	CRIT_OT	Critical Over-Temperature	Manual Reset	Unit	Internal DySC temperature exceeded maximum rating. Mechanical bypass commanded.	Verify ambient temperature is within DySC specification. Check for damaged fans. Check for dirty or obstructed air filters. Manually reset DySC.
48	FUSE_OPEN	Fuse Open	Call Service	Unit	One of the DySC fuses was detected open. Mechanical bypass commanded.	Call service.
49	OPEN_SCR_A	Open SCR Phase A	Call Service	Static Switch	The SCR on the phase A module was detected open.	Call service.
50	OPEN_SCR_B	Open SCR Phase B	Call Service	Static Switch	The SCR on the phase B module was detected open.	Call service.
51	OPEN_SCR_C	Open SCR Phase C	Call Service	Static Switch	The SCR on the phase C module was detected open.	Call service.
53	DYN_BRAKE	Dynamic Brake Error	Call Service	Unit	A problem was detected with the DySC dynamic brake controller.	Call service.
58	PLC_ERR	Programmable Logic Controller Error	Call Service	PLC	PLC error detected.	Call service.
59	PLC_ST_MM	Programmable Logic Controller State Mismatch	Call Service	Unit	PLC feedback error detected.	Call service.

Servicing

ATTENTION: Service must be performed by qualified personnel only.

Before attempting any servicing that requires opening the HC-DySC doors first put the system into *Bypass* (maintenance) mode as described in Maintenance Bypass Operation on page 16.

WARNING: The HC-DySC is interlocked. Opening cabinet doors while the system is in operation will result in loss of power to protected loads, unless the bypass switch is in the BYPASS position.

Circuit Breaker CBI, Safety Interlocks and Stored Energy

Figure 8 on page 16 shows the arrangement of circuit breakers CBI and CBA and of the bypass switch contacts INPUT, OUTPUT and BYPASS. If the cabinet doors are opened while the HC-DySC is operating the circuit breaker CBI will be automatically opened and load power will be interrupted unless the bypass switch is first put into the BYPASS position. Doors should be kept locked to avoid this situation.

The HC-DySC includes a fast-discharge circuit to quickly dissipate stored energy when the circuit breaker CBI is opened. Placing the bypass switch in BYPASS will automatically open CBI. CBI may be operated automatically by the door interlock switches or other protection devices. CBI can also be operated manually.

If the upstream power is interrupted before CBI is opened the fast-discharge circuit will not be triggered. In that case wait at least 30 minutes before opening the HC-DySC doors to avoid exposure to charged capacitors. High voltage remains on capacitors if the red LED indicators above the power module capacitor banks are lighted.

Circuit Breaker CBA and Fuses

Fast-acting fuses are included to protect the HC-DySC in the event of a load short circuit condition. If the system is found to be offline and the display shows an “Open Fuse” alarm then a load short circuit may have occurred. Verify no load short circuit condition exists before placing the bypass switch into the BYPASS position. Circuit breaker CBA will limit current through the bypass switch in case of a load short circuit condition while in the BYPASS mode. If there is no output voltage present and the display is off, it is an indication that either the CBA circuit breaker has opened or an upstream protection device has opened.

SHOCK HAZARD: Remove all power supplying the HC-DySC before removing the protective cover to reset the CBA circuit breaker. Replace all covers and doors before reapplying power to the HC-DySC.

WARNING: Turn the power to the HC-DySC electronics off by placing the Bypass Switch into BYPASS or opening the branch circuit breaker before replacing any fuse. Failure to comply with this warning can result in injury or death.

WARNING: The HC-DySC has high voltage remaining up to 30 minutes after disconnection from the AC line. Touching exposed or disconnected terminals, cables or parts of the HC-DySC can lead to serious injuries or even death. Wait for a minimum of 5 minutes before performing any service or testing on the HC-DySC after power is removed. Keep doors closed until all internal LED indicators are extinguished.

WARNING: Keep the cabinet doors closed to ensure proper cooling airflow and to protect personnel from dangerous voltages inside the HC-DySC

Fuse locations within the HC-DySC cabinet are shown on a label inside the door.

IMPORTANT A qualified electrician must replace the fuses. Open the front cabinet door(s) to access the fuse holders and fuses.

To maintain protection of the HC-DySC, be sure to replace the fuse with the same type and rating. These fuses are available through Rockwell Automation Technical Support.

Fuse Rating Charts

Table 12 - HC-DySC Enclosure Fuses

Fuse Reference	Fuse Location	Fuse Rating	Manufacturer Part Number
F1, F2, F3	Cabinet: Main Power Input	600A/500V	Mersen A50QS600-4IL
F4, F5, F6	Cabinet: Cross-Coupling Transformer	100A/600V	Mersen AJT100
F7, F8, F9 (3 wire models only)	Cabinet Neutral Forming Transformer	4A/600V	Mersen TRS4R
F10, F11	Cabinet: Input Control Transformer	1A/600V	Mersen TRS1R
F12, F13	Cabinet: Cross Coupler Auxiliary	2A/600V	Mersen ATQR2
F14, F15	Cabinet: Output Control Transformer	4A/600V	Mersen TRS4R
F16, F17, F18 F20 (4 wire only)	Cabinet: TVSS Input	40kA surge / 600V	Mersen VSP40-2
F19	Cabinet: Input Control Transformer	4A/600V	Bussmann FNQ-R-4
F1, F2	Power Module (x3): Voltage Feedback	2A/600V	Mersen ATQR2
F3	Power Module (x3)	--	Not Field Replaceable
F4, F5, F6, F7	Power Module (x3): Dynamic Brake	20A/600V	Mersen ATM20

Transient Voltage Surge Suppressor (TVSS)

The HC-DySC includes an internal TVSS device (or SPD), protecting the output (load). Indicator lights on the TVSS show if surge protection is not active (internally disconnected). Power to the TVSS module may be removed by opening the block of fuses F16-F17-F18 and F20 (present in 4-wire models only).

Specifications and Dimensions

Table 13 - Technical Specifications 200 A HC-DySC

Electrical Input/Output (Normal Mode—Static Switch)	
Connection Configuration	Series-connected with load. Under normal line condition, the static switch passes utility voltage directly to the load
Input Voltage	3-phase: 480V[1]
Voltage Range	± 10%
Available Short Circuit Current	25kA
Current Overload (Static Switch)	150% @ 30Sec., 400% @ 5 Sec., 600% @ 0.5 Sec.
Frequency	50/60 Hz Auto Sensing
Frequency Range	48 -62 Hz
TVSS	Output SPD, 40kA/mode
Efficiency	> 99% @ 480V
Electrical Output (Sag Correction Mode - Inverter)	
Output Voltage	Pre-sag rms voltage
Voltage Regulation	± 5% typical, +5% / -13% of nominal max
HC-DySC Output Current	200 A_{RMS}[2] Not rated for DC loads; max. allowable 2% DC loading
Crest Factor (at nameplate rms load)	1.45
Voltage Waveform	Sine wave
Voltage Sag Correction Times	
Single Event	
3 phase 87% to 50% Voltage Remaining	5 seconds
All three phases to zero voltage remaining	78 ms based on nameplate rated load with a power factor of 0.7
Multiple Event	
Max Sag Correction Time	5 seconds cumulative usage
Sequential Sag Recovery	0 seconds (assuming cumulative run-time available)
Full Recovery Time	Max 5 minutes
Mechanical	
Enclosure Ratings	NEMA 1 (IP20)
Cable Entry	Top or Bottom
Cooling	Filtered Forced Air
Access	Front for servicing and connections
Audible Noise	less than 60 dBA at 1m
Weight	1408 lb (639 kg)
Environmental	
Ambient Temperature	0 to 40°C
Storage Temperature	-40°C to 75°C
Relative Humidity	0 to 95% non-condensing
Altitude	Rated current available to 1000m (3300ft). De-rate output current 10% per 1000m, from 1000m to 3000m (9900ft).
Safety and Compliance	
Agency Approvals	cULus Listed (UL 1012)
Standards Compliance	Exceeds SEMI F47 Standard; IEEE Std C62.41.1 and UL 1449 3rd Ed. compliant

1. HC-DySC has not been evaluated for use in Corner Grounded or Ungrounded Delta Power Systems in systems rated over 240V.
2. When using HC-DySC with motor drive loads, either insert 3% to 5% line reactance at HC-DySC output or limit motor drive loads to 60% of HC-DySC rating

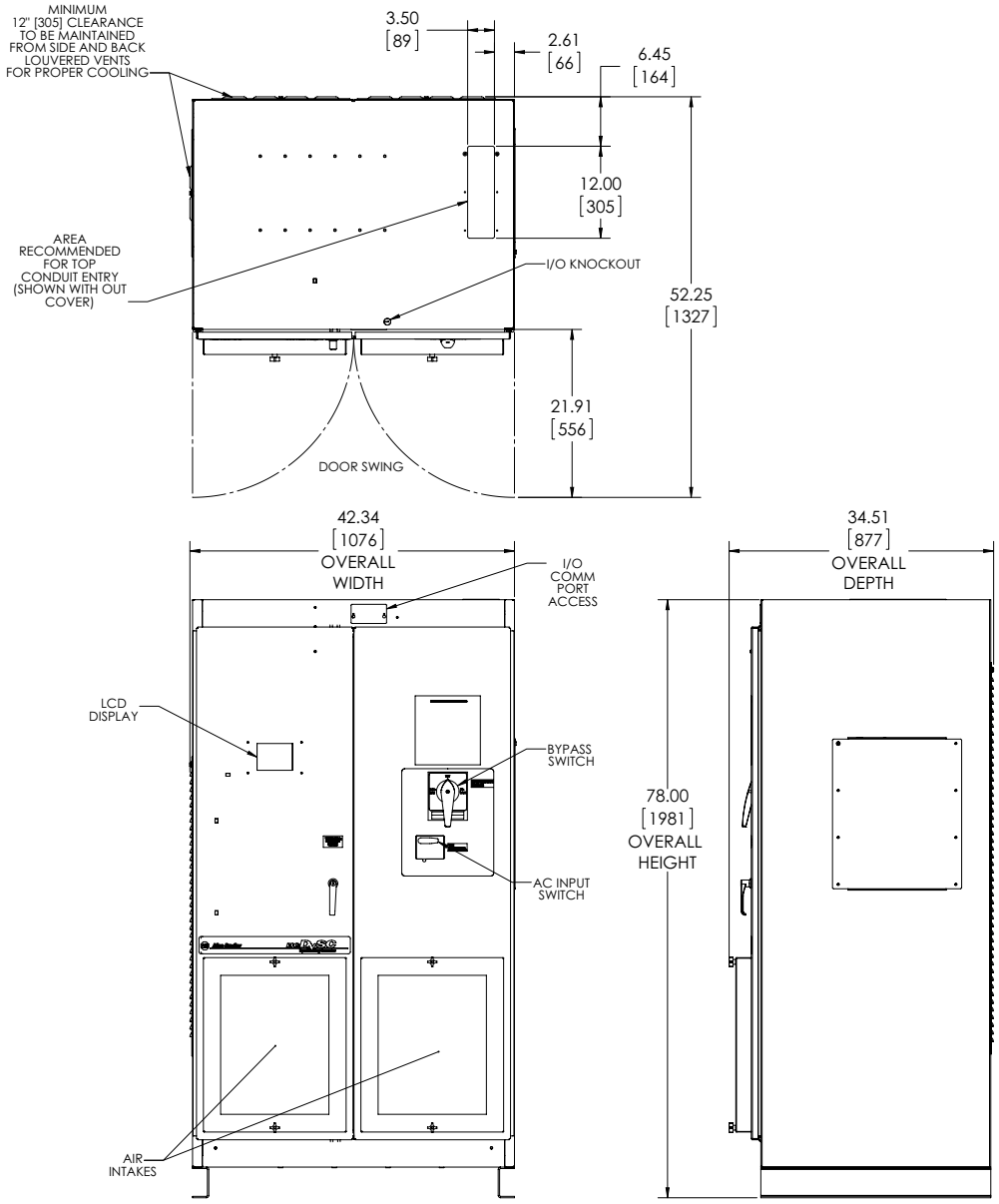
Table 14 - Heat Dissipation

Rating (V)	Heat Loss (W)	Heat Loss (Btu/h)	Efficiency (%)
480V	1664	5677	99%

Approximate Dimensions

Dimensions are shown in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.

Figure 30 - 200 A HC-DySC Dimensions



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